Epiphytes on *Nothofagus cunninghamii* and *Eucalyptus regnans* in a Victorian cool temperate rainforest

Claudette Kellar[1], Megan Short[1] and Josephine Milne[2]

[1]Deakin University, Burwood campus, 221 Burwood Hwy, Burwood, Victoria 3125
[2]National Herbarium of Victoria, Royal Botanic Gardens Melbourne,
Birdwood Avenue, South Yarra, Victoria 3141

Abstract

This study investigated the epiphytic communities on Myrtle Beech *Nothofagus cunninghamii* (Hook.) Oerst. and Mountain Ash *Eucalyptus regnans* F.Muell. trees in a pocket of Cool Temperate Rainforest in the Yarra Ranges National Park, Victoria, Australia. Twenty species were identified growing on *N. cunninghamii*, with nine species found on *E. regnans*. The dominant epiphytes were the moss *Dicranoloma menziesii* on *N. cunninghamii*, and the liverwort *Bazzania adnexa var. adnexa* on *E. regnans*. (*The Victorian Naturalist* **123** (4), 2006, 222-229)

Introduction

Cool Temperate Rainforests are unique environments that support a diversity of plants and animals. Their distribution in Victoria has become very fragmented due to deforestation, recurrent wildfires and, more recently, Myrtle Wilt has been identified as a disease affecting Myrtle Beech *Nothofagus cunninghamii* (Hook.) Oerst. (Peel 1999). In the Central Highlands Cool Temperate Rainforests, the canopy is dominated by *N. cunninghamii* and interspersed with Mountain Ash *Eucalyptus regnans* F.Muell. and Sassafras *Atherosperma moschatum* Labill. (Peel 1999) There is a notable abundance and diversity of bryophytes and lichens from the forest floor through to the canopy branches. While many of these cryptogams are found in other habitats, they are most abundant in rainforests. Indeed, cryptogams attain their greatest diversity in rainforests, often exceeding more than 35 species (Ashton and McCrae 1970; Dickinson *et al.* 1993; Jarman and Kantvilas 1995a; Louwhoff 1995; Milne and Louwhoff 1999; Franks 2000; Franks and Bergstrom 2000; Ford and Gibson 2000; Morley and Gibson 2004, Dalton 1998 cited in Roberts *et al.* 2005). The trunks of the two dominant tree species, *N. cunninghamii* and *E. regnans*, provide a diversity of microhabitats for epiphytic bryophytes and lichens, thus a complex array of species may coexist (Ashton and McRae 1970; McQuillan 1993). Milne and Louwhoff (1999) recorded 64 epiphytic species (28 bryophytes and 36 lichens) on just one fallen *N. cunninghamii* tree. Epiphytes are not confined just to overstorey species within rainforests. Large tree-ferns *Cyathea cunninghamii* Hook. f., *C. australis* and *Dicksonia antarctica* Labill., major components of the understorey of rainforests, also provide suitable substrata (Ford and Gibson 2000; Roberts *et al.* 2003, Roberts *et al.* 2005). In Tasmania, bryophytes, particularly mosses, comprise most of the species on tree ferns (Roberts *et al.* 2003, Roberts *et al.* 2005). In Victoria, lichens also are common on *Dicksonia antarctica* (Ford and Gibson 2000).

The distribution of epiphytes can be affected by host species, age of host tree, the physical characteristics (texture, porosity, thickness, stability), chemical characteristics (pH) and the nature of the plant substratum as well as many environmental factors including changes in the relative humidity, temperature and light regimes (Gimingham and Birse 1957; Gough 1975; Ashton 1986; Franks and Bergstrom 2000; Ford and Gibson 2000; Morley and Gibson 2004).

The aim of this study, which forms part of a larger investigation examining invertebrate assemblages in epiphytes (Kellar 1999), was to assess the vertical distribution of epiphytes to a height of 1.5 metres on *N. cunninghamii* and *E. regnans* in a Cool Temperate Rainforest, and to compare epiphyte diversity between the two tree species.

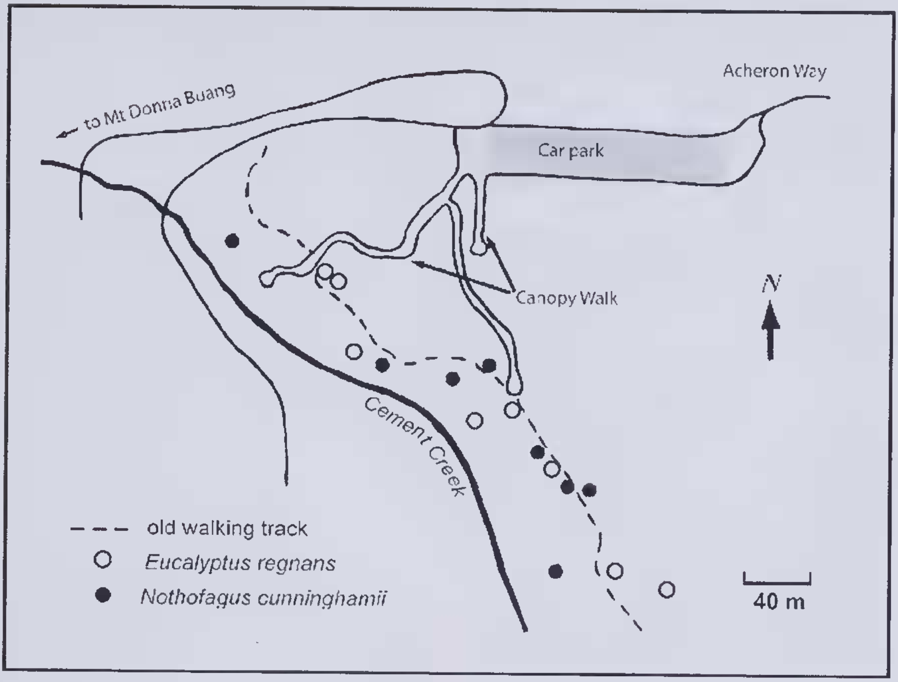

Fig. 1. Location of study site at Cement Creek, Yarra Ranges National Park, Victoria, Australia.

Methods

Study Site

This study was conducted in Cool Temperate Rainforest at Cement Creek in the Yarra Ranges National Park, Victoria (37° 41' S, 145° 42' E) (Fig. 1). The site is situated on the southern slopes of the Great Dividing Range and is 660 m above sea level. Cement Creek rises on the slopes of Mount Donna Buang, flows through the rainforest at the study site and down to the Yarra River. Temperatures range from -0.5 to 26.6 °C and the average annual rainfall is 1300 mm. Snow falls are fairly common at Cement Creek, with an average of six falls per year. The soils are volcanic in origin and contain rock fragments together with silt along the creek. The site is dominated by *N. cunninghamii,* and a number of *E. regnans* and *A. moschatum* are scattered throughout. The understorey consists of the tree-fern species *Dicksonia antarctica* and *Cyathea australis* (R.Br.) Domin, and the ground layer comprises a variety of ferns including *Hypolepis* sp. and *Blechnum wattsii* Tindale.

Data Collection

Two field collections were carried out, one in summer (February 1999) and one in autumn (May 1999). To minimise variability in tree size and age, only living trees of *N. cunninghamii* with a circumference between 2.5 and 3.5 m and *E. regnans* with a circumference between 6 and 8 m were selected for sampling. Eight trees of each species were sampled, as this was the maximum number of trees found in the area that were within the specified size range. Epiphytes were sampled at three heights: 0.5, 1 and 1.5m (Fig. 2). Four samples 5 x 5 cm were collected from each trunk, within a 45° arc either side of due south. The four samples collected at each height were amalgamated and treated as one bulk sample for each height. Epiphyte species in each of the samples were identified and cover abundance estimated. Taxonomic nomenclature follows Streimann and Klazenga (2002) for mosses, and McCarthy (2003) for liverworts.

Data Analysis

Statistical analysis was undertaken using the statistical package SYSTAT version 10 (Wilkinson, 1990) and PRIMER 5 (Clarke

Table 1. Epiphytes present and Mean % Cover abundance on *Nothofagus cunninghamii* and *Eucalyptus regnans* at Cement Creek, Victoria (n = 48 samples for each host tree species).

Taxon		*N. cunninghamii*	*E. regnans*
Liverworts			
Acrobolbaceae	*Marsupidium surculosum* (Nees) Schiffn.	0.08	
Lepidolaenaceae	*Gaekstroemia weindorferi* (Herzog) Grolle	0.02	
Lepidoziaceae	*Bazzania adnexa* (Lehm. and Lindenb.) Trevis. *var. adnexa*	7.56	74.22
	Kurzia compacta (Steph.) Grolle		0.45
Metzgeriaceae	*Metzgeria furcata* (L.) Dumort.	0.02	
Plagiochilaceae	*Plagiochila fasciculata* Lindenb.	0.8	
	Thallose liverwort sp. 1	0.007	
Mosses			
Aulacomniaceae	*Lepthotheca gaudichaudii* Schwägr.	0.55	
Dicranaceae	*Dicranoloma menziesii* (Taylor) Renauld	56.15	
	Dicranoloma platycaulon Dixon	1.23	
Hypnaceae	*Hypnum cupressiforme* Hedw.	2.01	
Rhizogoniaceae	*Rhizogonium pennatum* Hook. f and Wilson	2.06	7.71
Sematophyllaceae	*Wijkia extenuata* (Brid.) H.A.Crum	17.52	1.27
Lichens			
Cladiaceae	*Cladia aggregata* (Sw.) Nyl.	1.55	3.23
Deuteromycotina	*Lepraria* sp.	0.12	
Lobariaceae	*Pseudocyphellaria* sp.	0.17	
	Foliose sp. 1	0.24	0.098
Ferns			
Grammitidaceae	*Grammitis billardieri* Willd.	1.34	0.19
Hymenophyllaceae	*Hymenophyllum rarum* R.Br.	1.21	8.02
	Fern sp. 1	0.01	
	Fern sp. 2		0.002
Fungi			
	Fungus sp. 1	0.05	

and Warwick, 1994). Cover abundance and richness were tested using double within-subject repeated measures ANOVAs with tree species as the between factor, and season and height the within factors. An Arcsine transformation was performed on cover abundance of the three dominant species of epiphytes and a log transformation was performed on species richness to improve the normality and heterogeneity of variances.

Non-metric multi-dimensional scaling (NMDS) was applied to the cover abundance of epiphyte species using the software package PRIMER (Plymouth Routines in Multivariate Ecological Research). The procedure was carried out on epiphyte abundance to generate a Bray-Curtis similarity matrix. Separate two-dimensional ordination plots were generated for summer and autumn using replicates for the cover abundance of epiphytes. Two-way analyses of similarities (ANOSIM) were used to test the hypothesis that there were no differences in assemblages between trees and height.

Results

A total of 22 species of epiphytes was found in this study. Mosses and liverworts were the dominant epiphytes on both host trees. Twenty species of epiphytes were recorded on *N. cunninghamii* while only nine species were recorded for *E. regnans* (Table 1). *Nothofagus cunninghamii* had an overall higher cover of epiphytes than *E. regnans*. The dominant epiphytes found on *N. cunninghamii* were the mosses *Dicranoloma menziesii* (56%) and *Wijkia extenuata* (17.5%), and the liverwort *Bazzania adnexa var. adnexa* (7.5%) (Table 1). Other species found occurred in low abundance. In contrast *B. adnexa var. adnexa* (74%), the filmy fern *Hymenophyllum rarum* (8%) and the moss *Rhizogonium pennatum* (7.71%) were the most dominant epiphytes on *E. regnans* (Table 1).

The patterns of distribution shown by the dominant epiphyte species were significantly different between the tree species. The species fall into three distinct

Table 2. Presence of epiphyte species in different trees/height samples. Numbers represent the number of samples in which each species was found (Total samples at each height for each tree species = 16).

Cryptogam	*Nothofagus cunninghamii*			*E. regnans*		
	0.5 m	1 m	1.5 m	0.5 m	1 m	1.5 m
	GROUP A					
Dicranoloma menziesii	16	16	15			
Hypnum cupressiforme	5	5	10			
Dicranoloma platycaulon		5	5			
Leptotheca gaudichaudii		5	7			
Plagiochila fasciculata		2	2			
Lepraria sp.		1	1			
Pseudocyphellaria sp.		1	1			
Fungus sp. 1	1	1				
Marsupidium surculosum	1					
Metzgeria furcata			1			
Gaekstroemia weindorferi			1			
Liverwort (thallose) sp. 1		1				
Fern sp. 1	1					
	GROUP B					
Rhizogonium pennatum	1	4	5	11	6	8
Hymenophyllum rarum	5	6	7	8	6	8
Bazzania adnexa var. *adnexa*	12	15	15	16	16	16
Lichen (foliose) sp. 1	3	3	4	1	2	3
Cladia aggregata	6	7	6	8	9	10
Grammitis billardieri	5	3	2	3	1	
Wijkia extenuata	15	14	16	3	2	
	GROUP C					
Kurzia compacta				1	2	1
Fern sp. 2				1		
Total	12	16	16	9	8	6

Table 3. Results of doubly within-subject repeated measures ANOVA for bryophyte species richness on *Nothofagus cunninghamii* and *Eucalyptus regnans*.

Source of Variation	Species Richness		
	Df	MS	F
Between subjects			
Tree Species	1	0.227	30.971***
Error	14	0.007	
Within Subjects			
Season	1	0.001	0.289
Season x Tree Species	1	0.022	6.668*
Error (Season)	14	0.003	
Height	2	0.002	0.979
Height × Tree species	2	0.016	6.769**
Error (Height)	28	0.002	
Season × Height	2	0.004	0.148
Season × Height × Tree Species	2	0.005	0.126
Error (Season × Height)	28	0.002	

Significance of F-ratios: *P <0.05; **P <0.01; ***P <0.001

Table 4. Results of doubly within-subject repeated measures ANOVA for the mean % cover abundance of the dominant epiphytes species.

Source of Variation	Df	*Bazzania adnexa* var. *adnexa* MS	F	*Dicranoloma menziesii* MS	F	*Wijkia extenuata* MS	F
Between subject							
Tree Species	1	58610.585	119.086***	56611.228	140.302***	9873.760	20.586***
Error	14	492.169		403.496		479.645	
Within Subjects							
Season	1	34.099	0.261	0.085	0.001	178.668	2.799
Season × Tree Species	1	100.618	0.770	0.085	0.001	5.015	0.079
Error (Season)	14	130.735		114.250		63.842	
Height	2	29.804	0.286	303.712	2.339	115.557	0.842
Height × Tree Species	2	11.214	0.108	303.712	2.339	234.691	1.710
Error (Height)	28	104.121		129.853		137.268	
Season × Height	2	113.608	2.079	19.362	0.173	212.491	2.766
Season × Height × Tree Species	2	91.144	1.668	19.362	0.173	303.964	3.957*
Error (Season × Height)	28	54.648		111.897		76.813	

Significance of F-ratios: *P <0.05; **P <0.01; ***P <0.001

assemblages (Table 2). Group A includes all those epiphyte species specific to *N. cunninghamii*. Group C all those specific to *E. regnans* while Group B comprises 'cosmopolitan' species widespread on both *N. cunninghamii* and *E. regnans* (Table 2). On *N. cunninghamii*, total epiphyte species richness increased with height from 12 species at 0.5 m to 16 species at 1.5 m (Table 2), while on *E. regnans* there was a reduction in total species richness from nine species to six at 0.5 m and 1.5 m respectively. This interaction between tree species and height was statistically significant (P <0.01). Although the difference in species richness between the two host tree species was significant (P <0.001), height and season were not the significant factors influencing epiphyte distribution (Table 3).

The mean percentage cover abundance of each of the three dominant epiphytes on the two host tree species was found to differ significantly (P <0.001); however, height from ground and season were not significant influences on the pattern of distribution of these three epiphytes on the two host tree species (Table 4). For both seasons, the NMDS plot (Fig. 2) and the ANOSIM results indicate there were differences in epiphyte community structure between *N. cunninghamii* and *E. regnans* (summer: P = 0.001, global R = 0.938; autumn: P = 0.001, global R = 0.969). There was, however no difference in community structure in relation to height up the trunk (summer: P = 0.486, global R = 0.003; autumn: P = 0.951, global R = 0.049).

Discussion

The epiphyte communities on the two dominant tree species of the forest at Cement Creek were found to be distinct, with *N. cunninghamii* having a different assemblage of cryptogam species as well as a higher epiphyte species richness and cover abundance than *E. regnans*. There was a distinct assemblage of cryptogams on trunks of both host species. Lichens were not present in high abundances as they are-

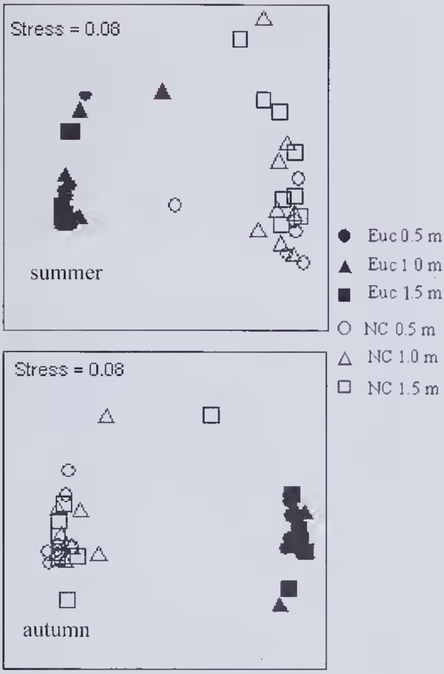

Fig. 2. Non-metric multi-dimensional scaling ordinations for epiphytes present at different heights (0.5, 1, 1.5 m) on *Nothofagus cunninghamii* (NC) and *Eucalyptus regnans* (Euc) in summer and autumn.

less tolerant to the damp andfitered light conditions at the trunk heights sampled in this study, and are more likely to occur higher up the tree where there is greater light (Kantvilas *et al.* 1985; Kantvilas 1988; Louwhoff 1995; Milne and Louwhoff 1999). The moss *D. menziesii* was dominant on *N. cunninghamii* while the liverwort *B. adnexa var. adnexa* was dominant on *E. regnans*. This supports the findings of Ashton and McCrae (1970) and Tyshing (2003) that *D. menziesii* is the dominant species on *N. cunninghamii*, and Ashton's (1986) study in which he found *Bazzania* to be the most dominant on *E. regnans*.

There are many factors that influence the distribution of epiphytes, with the most significant being characteristics of the substratum (Jarman and Kantvilas 1995b; Eldridge and Tozer 1997; Morley and Gibson 2004). The different properties of bark, such as texture, pH, age, ability to fissure, and moisture retention can all affect the distribution of epiphytes. The bark of *N. cunninghamii* is rigid, stable and corrugated, thus creating many different microhabitats for epiphytes to establish (Ashton and McCrae 1970). Within these corrugations there also is an accumulation of humus, which improves the likelihood of spore germination and the establishment of gametophytes. The bark of *E. regnans* is subfibrous in the butt area from 0-3m while the trunk above is smooth, with strips that are shed periodically. The instability of *E. regnans* bark is a factor likely to affect epiphyte species with the outermost layers known to flake off in dry periods and in heavy rain (Ashton 1986). Only the more hardy and faster growing epiphytes therefore would be expected to establish. In contrast, the sub-fibrous acidic nature and high water content of the butt suggests that it is particularly suitable for epiphyte establishment, especially liverworts such as *B. adnexa var. adnexa* (Ashton 1986).

Light intensity and humidity also affect epiphyte distribution. The different growth forms of the two trees influence light penetration and air flow onto their trunks. *Nothofagus cunninghamii* has many lateral branches that occur all along the tree, with many small leaves that are horizontally positioned and hence reduce the sunlight filtering through as well as restricting air movement. *Eucalyptus regnans* is much taller with lateral branching high in the canopy, and leaves positioned vertically, allowing more sunlight and air to pass to the lower trunk and litter beneath. The large number of epiphyte species found only on *N. cunninghamii* possibly were unable to tolerate the higher light and lower air humidity of *E. regnans*.

The increase in diversity of epiphytes with increasing height on *N. cunninghamii* may be due to the reduction of the dominant species *D. menziesii*, which is less tolerant to desiccation (Milne and Louwoff 1999). Jarman and Kantvilas (1995b) suggest that the epiphytes that survive higher up the trunk are those tolerant to desiccation. Franks and Bergstrom (2000) observed that moisture availability influenced the composition of epiphytic bryophytes on *Nothofagus moorei* (F.

Muell.) Krasser, with some bryophytes species being restricted to the basal trunk and other species (e.g. *Wijkia extenuata*) showing no restriction in vertical distribution. The reduced abundance of *D. menziesii* would encourage establishment of more tolerant epiphytes, thus increasing diversity. The decrease in species numbers up the trunk of *E. regnans* would be due to *B. adnexa* var. *adnexa* outcompeting other species and preventing their establishment. Presence of greater species richness at the base of the trunk may also be due to the local topography of the *E. regnans* butt with its many ridges, which would offer different degrees of protection and concentration of trunk water flow.

Interspecific competition is especially prevalent in plant communities (Begon 1996) and may also be a contributing factor determining epiphyte community structures on *E. regnans* and *N. cunninghamii*. *Bazzania adnexa var. adnexa* appears to outcompete and in fact exclude the establishment of other epiphyte species on *E. regnans* (Ashton 1986). This is likely to be due to the growth form of *B. adnexa* var. *adnexa* being a thick, dense mat, which does not allow the spores of other species to establish. While it still grows on *N. cunninghamii* it is possibly limited by sub-optimal conditions (such as lower light) preventing it from out-competing other species. No species appears to be excluding other species on *N. cunninghamii*, allowing high species richness to be maintained. *Dicranoloma menziesii*, the dominant species on *N. cunninghamii*, has an open turf growth form, allowing other species (e.g. small liverworts) to grow between the shoots and hence enabling a wide variety of epiphytes to establish.

This study showed that vertical zonation does not occur on either of the two host tree species in the first 1.5 m of the trunk. However, the differences found between epiphyte communities are significant and illustrate the importance of maintaining not only a diversity of host tree species, but also the integrity (i.e. moisture and light regimes) of the rainforest.

Acknowledgements

The authors would like to thank Dr Anneke Veenstra-Quah, Bernadette Sinclair and Richard Gough for their assistance in the field, Jeff Jeanes (MEL) and Dr Sharon Morley (DPI Knoxfield) for confirmation and identification of ferns and lichens, Dr Gerry Quinn (Deakin University) and Dr Ralph MacNally (Monash University) for statistical advice, and Prof Rod Seppelt (Australian Antarctic Division) for invaluable comments.

References

Ashton D (1986) Ecology of bryophytic communities in mature *Eucalyptus regnans* F. Muell. forest at Wallaby Creek, Victoria. *Australian Journal of Botany* **34**, 107-129.

Ashton D and McCrae R (1970) The distribution of epiphytes on beech (*Nothofagus cunninghamii*) trees at Mt. Donna Buang, Victoria. *The Victorian Naturalist* **87**, 253-261.

Begon M, Harper J and Townsend C (1990) Ecology: Individuals, Populations and Communities, 3 ed (Blackwell Scientific: Melbourne)

Clarke K and Warwick R (1994) *Change in marine communities: an approach to statistical analysis and interpretation.* (Natural Environment Research Council: Plymouth, UK)

Dickinson K, Mark F and Dawkins B (1993) Ecology of lianoid/epiphytic communities in coastal podocarp rain forest, Haast Ecological district, New Zealand. *Journal of Biogeography* **20**, 687-705.

Eldridge D and Tozer M (1997) Environmental factors relating to the distribution of terricolous bryophytes and lichens in semi-arid eastern Australia. *The Bryologist* **100**, 28-39.

Ford S and Gibson M (2000) Lichens of the soft tree-fern *Dicksonia antarctica* Labill. in Victorian rainforest. *The Victorian Naturalist* **117**, 172-179.

Franks A (2000) Biogeographical distribution of corticolous bryophytes in microphyll fern forests of south-east Queensland. *Proceedings of the Royal Society of Queensland* **109**, 49-57.

Franks A and Bergstrom D (2000) Corticolous bryophtyes in microphyll fern forests of south-east Queensland: distribution on Antartctic beech (*Nothofagus moorei*). *Austral Ecology* **25**, 386-393

Gimingham C and Birse E (1957) Ecological studies on growth-form in bryophytes 1. Correlations between growth-from and habitat. *Journal of ecology* **45**, 533-545.

Gough L (1975) Cryptogam distributions of *Pseudotsuga menziesii* and *Abies lasiocarpa* in the Front Range, Boulder County, Colorado. *The Bryologist* **78**, 124-145.

Jarman S and Kantvilas G (1995a) Epiphytes on an old Huon pine tree (*Lagarostrobos franklinii*) in Tasmanian rainforest. *New Zealand Journal of Botany* **33**, 65-78.

Jarman S and Kantvilas G (1995b) A floristic study of rainforest bryophytes and lichens in Tasmania's myrtle-beech alliance. The Tasmanian component of the National Rainforest Conservation Program.

Kantvilas G (1988) Notes on Tasmanian rainforest lichens. *The Tasmanian Naturalist* **95**, 1-7.

Kantvilas G, James PW and Jarman SJ (1985) Macrolichens in Tasmanian rainforests. *Lichenologist* **17**, 97-83.

Kantvilas G and Jarman S (1993) The cryptogamic flora of an isolated rainforest fragment in Tasmania. *Botanical Journal of the Linnean Society* **111**, 211-228.

Kellar C (1999) Epiphytes as a habitat for invertebrates in a cool temperate rainforest at Cement Creek, Victoria. (Unpublished BSc Honours Thesis, Deakin University)
Louwhoff S (1995) *The Lichen Flora of Mt Donna Buang*. (Unpublished Masters Thesis, Deakin University)
McCarthy PM (2003) Catalogue of Australian liverworts and hornworts. Flora of Australia Supplementary Series No. 21. (Australian Biological Resources Study, Canberra)
McQuillan P (1993) *Nothofagus* (Fagaceae) and its invertebrate fauna – an overview and preliminary synthesis. *Biological Journal of the Linnean Society* **49**, 317-354.
Milne J and Louwhoff S (1999) Vertical distribution on bryophytes and lichens on a Myrtle Beech, *Nothofagus cunninghamii* (Hook.) Oerst. *Hikobia* **13**, 23-30.
Morley S and Gibson M (2004) Cool temperate rainforest lichens of Victoria, Australia: Floristics and distribution. *The Bryologist* **107**, 62-74.
Peel B (1999) Rainforests and Cool Temperate Mixed Forests of Victoria. (Department of Natural Resources and Environment: East Melbourne)
Roberts N, Dalton PJ and Jordon GJ (2003) A species list for the bryophytes and ferns occurring on Tasmanian tree ferns. *Hikobia* **14**, 25-31.
Roberts N, Dalton PJ and Jordon GJ (2005) Epiphytic ferns and bryophytes of Tasmanian tree-ferns: A Comparison of diversity and composition between two host species. *Austral Ecology* **30**, 146-154.
Streimann H and Klazenga N (2002) Catalogue of Australian mosses. *Flora of Australia* Supplementary Series No. 17. (Australian Biological Resources Study: Canberra)
Tyshing C (2003) Niche specificity of spore dispersal mechanisms in mosses. (Unpublished BSc Hons Thesis, Deakin University)
Wilkinson L (1990) *SYSTAT: The System for Statistics*. Systat Inc. (Evanston: Illinois)

Received 13 April 2006; Accepted 15 June 2006

Epiphytic bryophytes of *Dicksonia antarctica* Labill. from selected pockets of Cool Temperate Rainforest, Central Highlands, Victoria

Aaron B Floyed and Maria Gibson

Plant Ecology Research Unit, School of Life and Environmental Sciences,
Deakin University, 221 Burwood Highway, Burwood, Victoria 3125

Abstract

Epiphytic bryophytes of the Soft Tree-fern *Dicksonia antarctica* Labill. were examined in four Cool Temperate Rainforest pockets of the Central Highlands of Victoria. Thirty-two species, 17 mosses and 15 liverworts, were noted. There was no distinction in species assemblage between the north and south side of tree-ferns although bryophytes occurred on the south side of more tree-ferns than they did on the north side. (*The Victorian Naturalist* **123** (4), 2006, 229-235)

Introduction

Victorian Cool Temperate Rainforest is restricted to small pockets and ribbons found in gullies and along ridge tops (Howard and Ashton 1973; Busby 1986). These pockets are dominated by Myrtle Beech *Nothofagus cunninghamii* (Hook.) Oerst. with smaller trees such as Blackwood *Acacia melanoxylon* R.Br. and Southern Sassafras *Atherosperma moschatum* Labill. forming the understorey along with the Soft Tree-fern *Dicksonia antarctica* Labill. and Rough Tree-fern *Cyathea australis* (R.Br.) Domin. (Howard and Ashton 1973; Jarman and Brown 1983). The Soft Tree-fern (Fig. 1) is much more common than the Rough Tree-fern and frequently has a luxuriant cover of bryophytes (Cameron 1992; Jarman *et al.* 1986; Ough and Murphy 1996; Peacock 1994; Roberts *et al.* 2003), but only one published study has documented the bryophytes of tree-ferns. Roberts *et al.* (2003) listed 81 bryophytes on Soft Tree-ferns and fifty-two on Rough Tree-ferns in Tasmania.

This study examined the bryophytes of Soft Tree-ferns in selected Cool Temperate Rainforest pockets in Victoria.

Methods

Four pockets of Cool Temperate Rainforest from the Central Highlands of